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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 09/884,863 | 06/18/2001 | Richard B. Merrill | FOV-053 | 2875 |

7590 05/23/2003

Kenneth D'Alessandro
Sierra Patent Group, Ltd.
P.O. Box 6149
Stateline, NV 89449

| EXAMINER |
|---|
| COLEMAN, WILLIAM D |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2823 | |

DATE MAILED: 05/23/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

| Application No. | Applicant(s) |
|---|---|
| 09/884,863 | MERRILL, RICHARD B. |
| **Examiner** | **Art Unit** |
| W. David Coleman | 2823 |

## *Office Action Summary*

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *20 February 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *13-29* is/are allowed.

6)☒ Claim(s) *1-3,5,6 and 9* is/are rejected.

7)☒ Claim(s) *4,7 and 10-12* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☒ The proposed drawing correction filed on *February 20, 2003* is: a)☒ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a)☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

1)☐ Notice of References Cited (PTO-892)
2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3)☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). 5
4)☐ Interview Summary (PTO-413) Paper No(s). _____
5)☐ Notice of Informal Patent Application (PTO-152)
6)☐ Other:

## DETAILED ACTION

### *Response to Arguments*

Applicants amendment filed February 20, 2003 in paper no. 9 has been considered.

Applicant contends that Yoshikawa et al., U.S. Patent 4,318,115 herein known as Yoshikawa fails to teach three detector layers as recited in claim 1.

In response to Applicant's contention that Yoshikawa fails to teach the formation of at least three detector layers, it is well known that the detector layers are often termed "photodiodes" PD. FIG. 25 of Yoshikawa discloses at least three photodiodes, i.e., $PD_0$, $PD_1$ and $PD_2$, meaning there are at least three detector layers suggest by Yoshikawa. Furthermore, Applicant is reminded that it is not only what FIG. 3 teaches, but the reference as a whole is used in the rejection of the claimed subject matter.

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 3 and 5 are rejected under 35 U.S.C. 102(b) as being anticipated by Yoshikawa et al., U.S. Patent 4,318,115.

3. Pertaining to claim 1, Yoshikawa discloses a semiconductor device as claimed. See **FIGS. 1-29** where Yoshikawa teaches a vertical color filter detector group formed on a semiconductor substrate and comprising at least three detector layers configured to collect photo-generated carriers of a first polarity, separated by additional intervening reference layers

configured to collect and conduct away photo-generated carriers of the opposite polarity, said at least three detector layers disposed substantially in vertical alignment with each other and having different spectral sensitivities as a function of their different depths in the semiconductor substrate (see **FIG. 24** and columns 3, lines 65-68 and column 4, lines 1-10).

4. Pertaining to claim 3, Yoshikawa teaches the vertical color filter detector group of claim 1 wherein said at least three detector layers are configured by doping to collect said photo generated carriers of a first polarity and said plurality of reference layers are configured by doping to collect and conduct away said photo-generated carriers of said opposite polarity.

5. Pertaining to claim 5, Yoshikawa teaches the vertical color filter detector group of claim 3 wherein said photo-generated carriers of a first polarity are negative electrons and said photo-generated carriers of said opposite polarity are positive holes.

## *Claim Rejections - 35 USC § 103*

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 2, 6, 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yoshikawa et al., U.S. Patent 4,318,115 as applied to claims 1, 3 and 5 above and in further view of Applicants Admitted Prior Art **FIG. 1** (AAPA).

8. Pertaining to claim 2, Yoshikawa discloses a semiconductor device substantially as claimed as discussed above. However, Yoshikawa fails to teach the vertical color filter detector group of claim 1 further comprising an individual active pixel sensor readout circuit coupled to each of said at least three detector layers. AAPA teaches a vertical color filter detector group comprising an individual active pixel sensor readout circuit coupled to each of said at least three detector layers. In view of AAPA, it would have been obvious to one of ordinary skill in the art to incorporate individual active pixel sensor readout circuits coupled to each of the three detector layers because the readout circuit measures current (pp 10, lines 5-6 of Applicants disclosure).

9. Pertaining to claims 6, 8 and 9 Yoshikawa fails to disclose the vertical color filter detector group of claim 1 wherein each detector group includes a blue photodetector at a blue-sensitive n-type layer at the surface of the semiconductor, a green photodetector at a green-sensitive n-type layer disposed at a first depth in said semiconductor, and a red photodetector at a red-sensitive n-type layer disposed at a second depth greater than said first depth in said semiconductor. AAPA teaches wherein each detector group includes a blue photodetector at a blue-sensitive n-type layer at the surface of the semiconductor, a green photodetector at a green-sensitive n-type layer disposed at a first depth in said semiconductor, and a red photodetector at a red-sensitive n-type layer disposed at a second depth greater than said first depth in said semiconductor. In view of AAPA, it would have been obvious to one of ordinary skill in the art to disclose the various wavelength colors in the Yoshikawa semiconductor device because the red photodiode is comprised of the junction between the p-type substrate and the n-type well, the green photodiode is comprised of the junction between the n-type well and the p-type well and

the blue photodiode is comprised of the junction between the p-type well and the n-type lightly-doped drain implant (Applicants disclosure, pp. 10 lines 1-5).

***Objections***

10. Claims 4, 7, 10, 11 and 12 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

***Allowable Subject Matter***

11. Claims 13-29 allowed.

12. The following is an examiner's statement of reasons for allowance: prior art does not anticipate nor render obviousness as to a vertical color filter detector group formed on a semiconductor substrate comprising at least six layers of alternating p-type and n-type doped regions, PN junctions formed between abutting ones of said doped regions operating as photodiodes having spectral sensitivities that are a function of junction depth from an upper surface of said at least six layers, first alternate ones of said doped regions disposed substantially in vertical alignment with each other and serving as detector regions to collect photo-generated carriers, second alternate ones of said doped regions that are not detector regions serving as reference regions coupled to a reference potential.

13. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue

the blue photodiode is comprised of the junction between the p-type well and the n-type lightly-doped drain implant (Applicants disclosure, pp. 10 lines 1-5).

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13. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue

fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

***Conclusion***

14. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

15. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to W. David Coleman whose telephone number is 703-305-0004. The examiner can normally be reached on 9:00 AM-5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7721 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

W. David Coleman
Primary Examiner
Art Unit 2823

WDC
May 15, 2003